REMARKS

Applicant has carefully reviewed the Official Action dated September 15, 2003 for the above identified patent application.

At page 2, paragraph 1 of the Official Action, the Examiner has objected to the drawing under 37 CFR 1.83(a) on the grounds that the drawing does not illustrate every feature of the invention specified in the claims. In response to this drawing objection, Applicant proposes to add FIGURE 4, a copy of which is enclosed for the Examiner's approval. The specification has also been amended to refer to and discuss newly added FIGURE 4. The addition of FIGURE 4, and the revision to the Specification discussing FIGURE 4, is supported by the disclosure of Claim 1, as originally filed. Original claims constitute original disclosure to a patent application, and both the drawings and the specification can be revised to illustrate and discuss features recited in an original claim without adding new matter to the application.

At page 2, paragraph 3 of the Official Action, Claims 1 - 12 have been rejected under 35 U.S.C. Section 112, second paragraph, as being indefinite. The basis for these formal grounds of rejection are discussed in the Official Action. The form of independent Claim 1 has been revised to overcome the formal

grounds of rejection raised in the Official Action. Applicant submits that the claims, as amended herein, comply with 35 U.S.C. Section 112, second paragraph, in all respects.

At page 3, paragraph 5 of the Official Action, independent Claim 1 has been rejected under 35 U.S.C. Section 102(b) as being anticipated by U.S. Patent No. 4,511,289 (Herron).

At page 3, paragraph 6 of the Official Action, independent Claim 1 has been rejected under 35 U.S.C. Section 102(b) as being anticipated by GB Patent No. 2,072,784 (Winston).

For the reasons to be discussed below, Applicant submits that independent Claim 1, as amended herein, is not taught or suggested by the prior art references applied to reject it in the Official Action. Only independent Claim 1 will be addressed in this Amendment since if this claim is allowed, the remaining Claims 2 - 12, each of which depends directly or indirectly from independent Claim 1, will be allowed at least for the same reasons as independent Claim 1.

Independent Claim 1, in addition to being revised to overcome the formal grounds of rejection, has been revised to further distinguish it from the applied prior art references. More specifically, the "characterized" portion of the claim has

been amended to recite that the tube (1) has a varying material thickness in a peripheral direction "when measured perpendicularly to the outer surface of the tube". This further limitation to the claim defines the nature of the existing recitation that the tube has a varying material thickness "in a peripheral direction", and more clearly distinguishes the claim from the two prior art references applied to reject independent Claim 1 in the Official Action.

Both of the references applied to reject independent Claim 1 in the Official Action, namely U.S. Patent No. 4,511,289 and GB 2,072,784, disclose elongated tubes (11) and (10) respectively. However, neither of these two references teaches or suggests an elongated tube having a varying material thickness in a peripheral direction, i.e., when measured perpendicularly to the outer surface of the tube, as now expressly recited in independent Claim 1. Moreover, neither of the two references recognizes the advantages resulting from the tube-formed rock bolt as defined by independent Claim 1, as more fully discussed in Applicant's specification as, for example, at page 1, third paragraph.

Independent Claim 1 has been rejected as being anticipated by the applied references. It is well established that a rejection of a claim as being anticipated by a prior art

reference requires the Patent & Trademark Office to establish a strict identity of invention between each rejected claim and a single applied prior art reference. Stated in other words, a rejection of a claim as being anticipated by a prior art reference is inappropriate unless the reference discloses all features of the rejected claim, as arranged in the claim. See, for example, Connell v. Sears, Roebuck & Co., 220 USPQ 193 (Fed. Cir. 1983).

Applicant respectfully submits that there is clearly no strict identity of invention between pending independent Claim 1 and either U.S. Patent No. 4,511,289 or G.B. Patent No. 2,072,784. Therefore, neither of these two references anticipates (or suggests) the tube-formed rock bolt, as defined by independent Claim 1.

Applicant submits that independent Claim 1 is in condition for allowance. Dependent Claims 2 - 12, which depend directly or indirectly from independent Claim 1 and include all features of that claim, are allowable at least for the same reasons as parent independent Claim 1.

Applicant respectfully submits that this application is in condition for allowance, and favorable action is respectfully requested.

Respectfully submitted,

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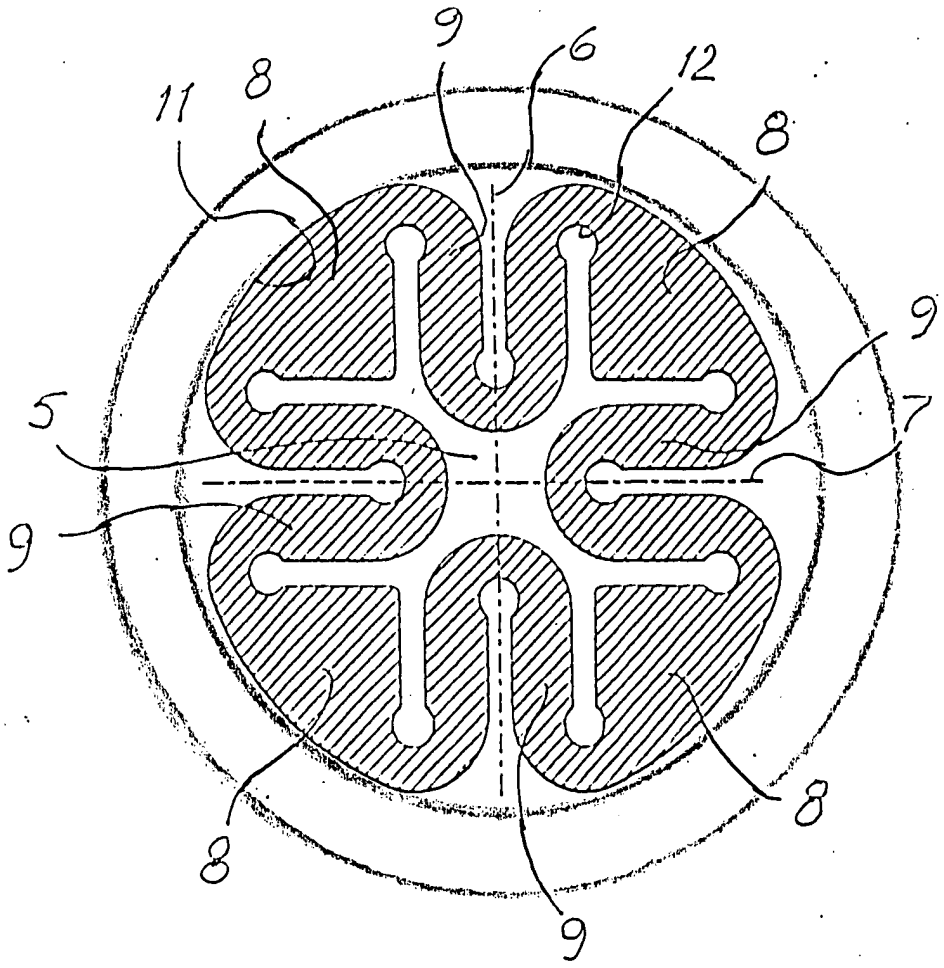

FIG. 4

Tube-formed rock bolt

The present invention relates to a tube-formed rock bolt with closed profile, which is inserted in a bore hole and then expanded into contact with the wall of the bore hole through plastic deformation by means of internal pressurisation.

In a previously known rock bolt, see e.g. US-A-4 509 889, a comparatively thin-walled tube of mild steel is used, which during manufacture is deformed such that its peripheral length is larger than the circumference of the bore hole. A drawback with this formation is that the tube is relatively thin-walled in order to allow deformation against the wall of the bore hole. This gives a comparatively small cross-sectional area, which restricts the tensile strength of the rock bolt. The unsymmetrical form of the rock bolt gives as result that the contact force against the rock varies along the periphery, which limits the load carrying capacity. A further drawback is that the steel material is exerted to corrosion attack.

The present invention, which is defined in the subsequent claims, aims at achieving a tube-formed rock bolt having a substantially higher tensile strength. This is achieved primarily because the rock bolt comprises a tube, which has a material thickness varying along the periphery. Through this one can increase the cross-sectional area of the tube substantially at the same time as one has parts, which are easily deformed so that the rock bolt gets a secure grip against the wall of the bore hole. The advantageous embodiments of the invention given in the subclaims give as results that the rock bolt obtains good corrosion resistance, is easy to manufacture and gives a good contact force against the wall of the bore hole around the hole.

~~Two~~ Three embodiments of the invention are described below with reference to the accompanying drawings in which fig. 1 shows a tube-formed rock bolt in perspective with one end closure removed in order to show the cross-sectional form. Fig. 2 shows a cross section through the bolt according to fig. 1 and schematically the surrounding bore hole in which the rock bolt is to be anchored. Fig. 3 shows an alternative embodiment of the invention. Fig. 4 shows a further alternative embodiment of the invention.

The tube-formed rock bolt shown in the drawings comprises an elongated tube 1 provided with two end closures 2,3. In the shown example the end closures are made as caps, which scalingly have been connected with the tube 1. Through this a room 5 is created between the tube 1 and the end closures 2,3. This room can be pressurised via a passage 4 at the end closure 2. The end closures can be achieved in other ways. The essential is that the ends of the tube 1 are sealed so that one through pressurisation of the room 5 can expand the tube 1 to contact against the bore hole 11. The tube 1 is, for instance, made by means of extrusion of an aluminium-based material, e.g. EN-AW 6082-T4. The tube 1 can thereby advantageously be given cross-sectional forms like those shown in figs 2 and 3. By making the profile symmetrical relative to the longitudinal sections 6,7 one obtains a relatively even distribution of the contact force between the tube 1 and the bore hole 11 after expansion of the bolt. One obtains about the same result with the bolt form shown in fig 3. This means that the bolt can be loaded more heavily without gliding in the bore hole. The bolt shown in fig 2 comprises four substantially triangularly formed parts 8, which have large cross-sectional areas and thus large stiffness and tensile strength. These parts are connected by means of U-shaped deformation parts 9. In order to increase the flexibility the tube profile has been provided with a number of circularly formed parts 12 at the deformation parts 9. Fig. 4 is identical to Fig. 2 except that the diameter of the largest transverse dimension of the tube 1 is equal to the diameter of the circle 11 representing the bore hole.

When a rock bolt is to be anchored in a bore hole the bolt is pushed into the bore hole with the end closure 3 at the inner end of the bore hole. Then pressure fluid is supplied via the passage 4 to the room 5 surrounded by the tube 1. Through this the tube 1 is expanded so that it contacts the wall of the bore hole 11 hardly. Then the room 5 is unloaded whereby the tube 1 remains firmly anchored, since the previous expansion has deformed the tube 1 plastically.

The invention can, of course, be varied within the scope of claim 1. The profile can, for instance, have more or fewer than four stiff parts. An example of this is shown in fig 3.